Performance analysis of spatial interpolation techniques for daily precipitation amount and further precipitation indices for a data sparse region

Jan Bliefernicht (1), Patrick Laux (2), Moussa Waongo (2), Thompson Annor (3), and Kunstmann Harald (2)

(1) University Augsburg, Chair for Regional Climate and Hydrology, Augsburg, Germany (jan.bliefernicht@geo.uni-augsburg.de), (2) Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research, Garmisch-Partenkirchen, Germany, (3) Federal University of Technology Akure, Graduate Research Program on the West African Climate System, Akure, Nigeria

Many hydrological applications need precipitation information at locations where measurements are often not available. To overcome this basic problem, the simplest way is to use spatial interpolation techniques for transferring the information from measurement sites to a location of interest. Since the performance of a spatial interpolation technique strongly depends on the availability of measurements, the technique might fail for a data sparse region. To address this question in more detail, we analyze the performance of various interpolation techniques ranging from a nearest neighbor approach to more sophisticated kriging techniques for the Volta basin in West Africa. This study region is characterized by a low station density, precipitation time series with long data gaps and less reliable measurements, high precipitation variability on different spatiotemporal scales and a strong demand of reliable techniques for providing spatially distributed precipitation data sets in a fine resolution. The target variables are the annual, monthly and daily precipitation amount and further daily precipitation indices e.g. the precipitation probability and transition probabilities. An interpolation of the latter variables is of interest e.g. as input information for a stochastic generation of daily precipitation time series at arbitrary (e.g. gridded) locations. The database is an archive of daily observations ranging from 1970 and 2010 collected at more than 200 sites. This precipitation archive is probably the most comprehensive data set with daily measurements for this region. The performance of the interpolation technique is determined based on a leave-one out cross-validation using sophisticated performance measures such as the linear error in probability space. The target variables are interpolated on a regular grid with a resolution of 5 km covering the Volta basin to provide this information for subsequent studies in this region. The outcomes of this study indicate that the selected kriging techniques slightly outperform the other techniques in many situations and seem to provide valuable information for many sites. However, the performance of an interpolation technique strongly depends on the spatial variability of the interpolation variable and is therefore low for an interpolation of the daily precipitation amount. In future, the gridded precipitation data sets are transferred to an online database to provide this information for hydrological and non-hydrological studies.